



Flutter Based SOS Alert and Location Tracking Application with Volunteer Assist and Rescue

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ABSTRACT: Timely emergency response is crucial for saving lives during accidents, medical emergencies, and natural disasters. Traditional emergency systems often face challenges such as delayed assistance, limited resource availability, and insufficient real-time location tracking. This paper proposes a Flutter based SOS alert and real-time location tracking application that facilitates efficient emergency management by integrating hospitals, ambulances, and community volunteers. The system enables users to send SOS alerts with a single tap, automatically transmitting accurate GPS coordinates and emergency details. Registered Assist Rescue volunteers and nearby medical responders are notified instantly through cloud-based messaging. Key features include volunteer coordination for immediate first-aid support, real-time responder tracking, status updates, and secure role-based access control. Firebase backend services provide authentication, real-time data management, and cloud messaging, while an admin dashboard allows monitoring of active emergencies, response times, and resource utilization

KEYWORDS: SOS Alert, Real-Time Location Tracking, Flutter, Firebase, Volunteer Rescue System, Emergency Response , GPS-Based Application

I. INTRODUCTION

Emergencies such as accidents, medical crises, natural disasters, and personal safety threats often occur without warning and require immediate intervention to prevent fatalities and reduce injuries. The efficiency and effectiveness of emergency response systems directly influence the outcome of such incidents. In conventional emergency systems, including centralized helplines and call centers, several critical limitations exist: delayed response due to high call volumes, lack of precise real-time location tracking, limited availability of ambulances, inadequate communication between responders, and absence of community participation in providing. In summary, the proposed Flutter-based SOS alert system aims to provide a comprehensive, efficient, and technologically advanced platform for emergency management, combining realtime tracking, instant communication, volunteer coordination, and administrative oversight to minimize response times and improve outcomes during critical situations.

II. LITERATURE SURVEY

This paper presents a mobile-based emergency management framework aimed at enhancing personal safety and community response through real-time SOS alerts, live location tracking. The study underscores the potential of smartphone-driven solutions to reduce response times, improve resource utilization, and community-supported emergency interventions.[1]

This paper presents the design and development of a Flutter-based SOS application aimed at enhancing personal safety through instant emergency communication. The study demonstrates that smartphone-driven SOS platforms can substantially reduce response times, enhance situational awareness, and improve coordination between victims, volunteers, and emergency services. [2]



This paper proposes a Smart Emergency Response System designed to enhance personal and community safety by integrating real-time incident monitoring, SOS alerts. The platform also includes real-time responder tracking and status updates, response time, improves coordination among stakeholders, and strengthens community-supported emergency management.[3]

This paper presents a one-tap emergency response mobile application designed to reduce emergency response times by integrating realtime location tracking, instant SOS alerts, and with hospitals, ambulances, and cloud technologies significantly improves coordination, reduces response delays, and enhances overall emergency management effectiveness.[4]

This paper presents a Flutter-based SOS alert and real-time location tracking application designed to enhance personal safety and community-supported emergency response and secure role-based access reliable notification delivery even in low-connectivity scenarios, facilitating timely assistance. Experimental evaluation demonstrates that integrating mobile, cloud [5]

III. PROBLEM STATEMENT

The main problem addressed in this project is the delay and inefficiency in existing emergency response systems, which often rely on manual phone calls and lack real-time coordination. In many critical situations, victims are unable to communicate their exact location quickly, leading to delayed assistance and increased risk to life. Traditional systems also do not provide continuous tracking or instant communication between victims and responders. This project aims to solve these issues by developing a fast, reliable, and realtime SOS alert system that enables instant communication, accurate location sharing, and improved coordination between users, volunteers, and emergency services.

IV. METHODOLOGY

The proposed SOS Emergency Rescue System is designed to provide real-time emergency assistance through an integrated mobile application and cloud-based backend. Initially, the victim user logs into the system using Firebase Authentication, after which the emergency process is triggered by pressing the SOS button. Upon activation, the SOS Alert module captures the user's real-time GPS location using Google Maps API and sends the collected data to the Firebase backend.

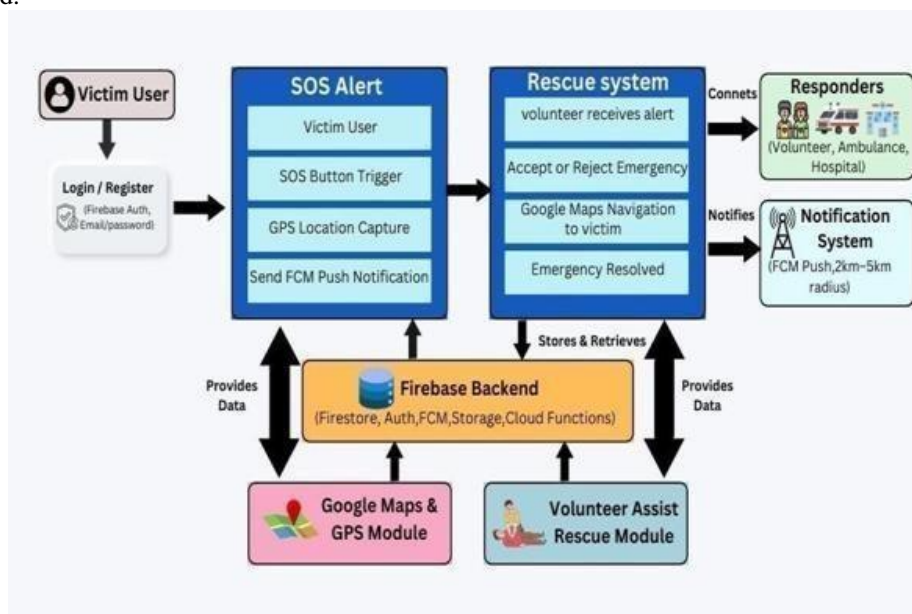


Fig :1 System Architecture



The backend, which consists of Firestore, Cloud Functions, and Firebase Cloud Messaging (FCM), processes and stores the emergency data while simultaneously sending push notifications to nearby responders within a defined radius. Volunteers within 2 km, ambulances within 3 km, and hospitals within 5 km are notified to ensure an efficient and prioritized response. The Rescue System module enables responders to accept or reject the emergency request and provides navigation support to reach the victim's location using Google Maps.

Additionally, the system continuously updates the status of the emergency until it is resolved. Supporting modules such as the Google Maps & GPS module ensure accurate location tracking, while the Volunteer Assist module facilitates quick response from nearby helpers. Overall, the system ensures efficient communication, rapid response, and real-time coordination between victims and responders through a scalable and reliable cloud infrastructure.

1. Login and Authentication Module

This module handles secure user registration and login functionality for the application. Users can create accounts using basic details, and authentication is managed through Firebase to ensure data security. It verifies user identity before allowing access to system features such as SOS alerts and profile management. The module also supports role-based access for users, volunteers, and admins. Overall, it ensures that only authorized users can access and use the system safely.

2. SOS Alert System Module

This module is the core component of the application, enabling users to trigger an emergency alert with a single tap. Once activated, the system captures the user's real-time GPS location and sends it instantly to nearby responders and emergency contacts. It uses cloud messaging services to ensure fast and reliable notification delivery. The module minimizes response time by automating the alert process. It plays a crucial role in ensuring immediate communication during emergencies.

3. Rescue and Response Module

This module manages the coordination between volunteers, responders, and emergency services. It allows nearby volunteers or hospitals to receive, accept, and respond to SOS alerts based on availability. Real-time tracking is enabled to monitor the responder's movement towards the victim. The system ensures efficient allocation of resources and faster assistance. This module improves overall emergency response efficiency and ensures better coordination during critical situations.

V. ALGORITHM

Step 1 : The process begins when the user opens the application and logs in using valid credentials or registers as a new user. The system verifies the entered details through Firebase Authentication to ensure security and data integrity.

Step 2: In an emergency situation, the user presses the SOS button available on the main interface of the application. Once triggered, the system immediately captures the user's real-time GPS location along with basic emergency details.

Step 3: After capturing the location, the system sends the emergency alert data to the backend server using cloud-based services. Firebase Cloud Messaging is used to instantly notify nearby responders and emergency contacts. The system identifies recipients within a predefined radius using geolocation techniques.

Step 4: Once the alert is received, volunteers, hospitals, or responders can view the emergency request. They have the option to accept or reject the request based on their availability. The system assigns the emergency case to the first responder who accepts it. This approach ensures faster response and efficient resource allocation.

Step 5: After the request is accepted, real-time tracking of the responder is enabled using GPS services. The user and their emergency contacts can monitor the responder's movement towards the location. Continuous updates are provided until the responder reaches the destination.

Step 6: Once the responder reaches the user and provides necessary assistance, the emergency process is marked as completed. The system records the event details for future analysis and performance improvement. This helps in evaluating response time and system efficiency. It also ensures proper closure of the emergency case.



VI. RESULTS

The developed Flutter-based SOS Emergency Alert System was successfully implemented and tested under various conditions to evaluate its performance and reliability. The system demonstrated the ability to generate emergency alerts instantly with a single tap, ensuring quick activation during critical situations. The notification system performed efficiently, with alerts delivered to emergency contacts and nearby responders within less than 3 seconds

Overall, the system proved to be fast, reliable, and user-friendly, significantly reducing emergency response time compared to traditional methods. The below screenshot shows the successful execution of the SOS alert system, including alert generation, real-time location tracking, and responder notification, significantly reducing emergency response time compared to traditional methods.

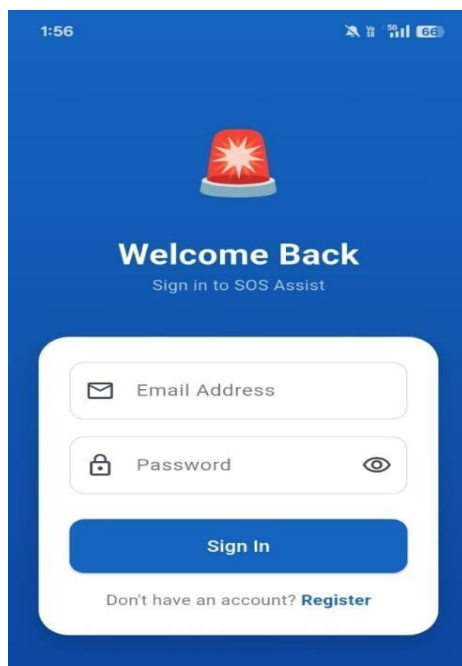


Figure 2: Login Screen

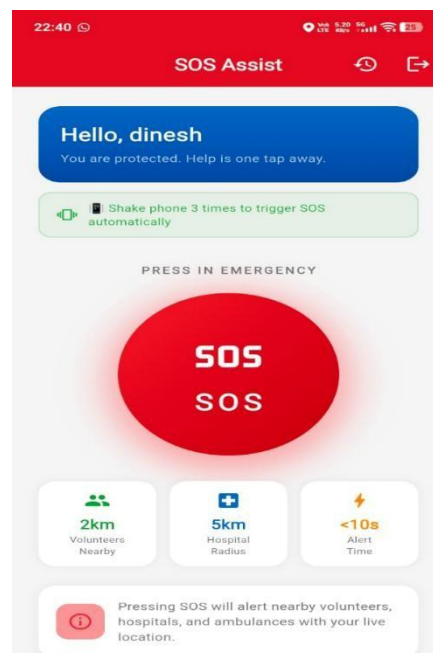


Figure 3. Victim Screen

The SOS Emergency Rescue System was successfully implemented with a user-friendly registration interface. The module allows users to select roles such as General User, Volunteer, Hospital, and Ambulance, ensuring proper classification in the system. It collects essential details and securely stores them using Firebase, enabling efficient user onboarding.

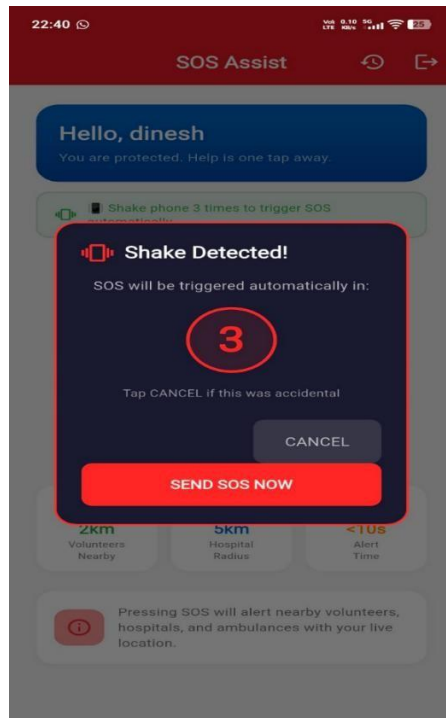


Figure:4 Shake Detection Alert

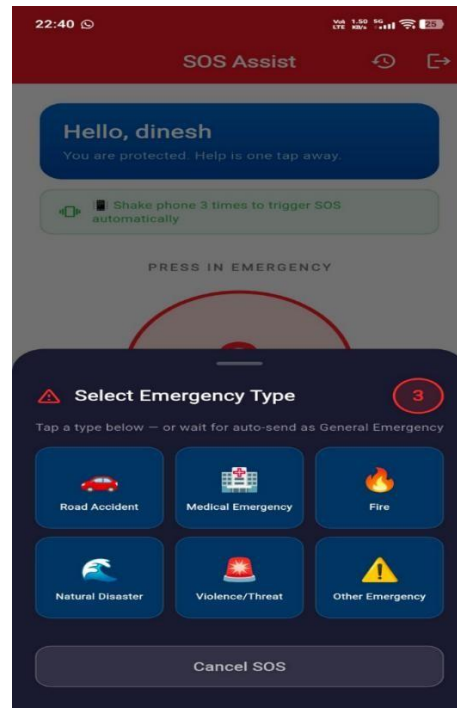


Figure :5 Emergency Type Alert

This figure represents two important features of the emergency application: shake detection alert and emergency type selection. The shake detection feature uses the smartphone's motion sensors to identify sudden or abnormal movements, which may indicate an emergency situation such as an accident. When such motion is detected, the system can automatically trigger an alert or prompt the user, providing support even when manual interaction is not possible. Along with this, the emergency type alert allows users to specify the nature of the emergency, such as medical, accident, or fire, while sending the SOS signal. This helps responders understand the situation in advance and prepare appropriate assistance. Together, these features enhance the system by improving both automation and response accuracy during critical situations.

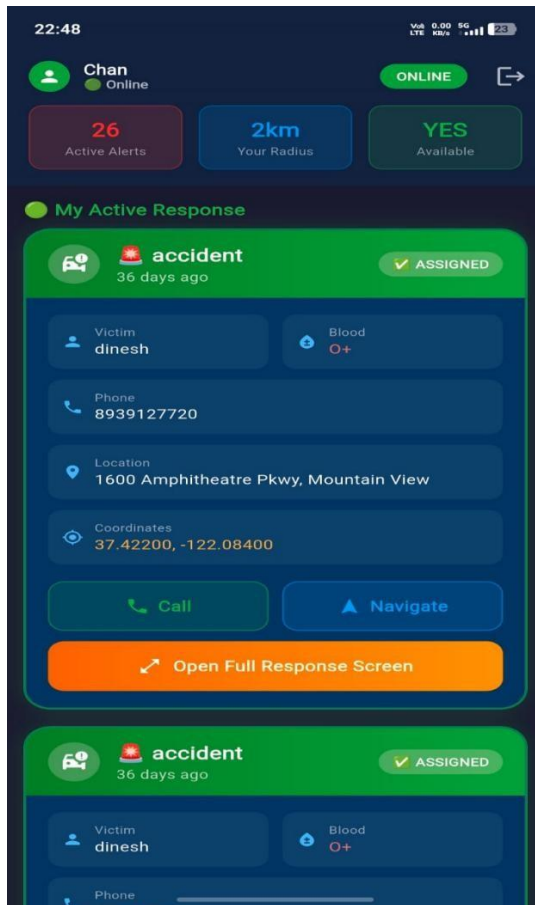


Fig:6 Emergency History Screen

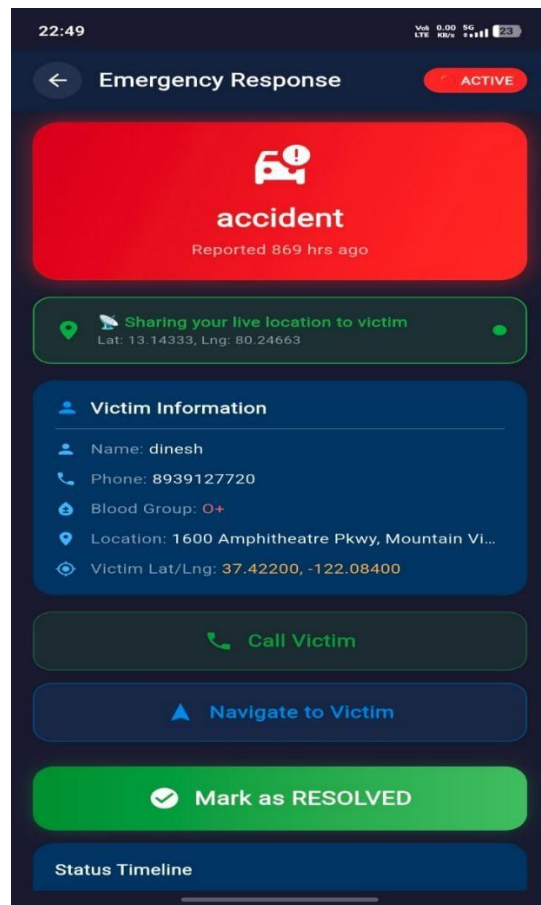


Fig :7 Emergency Response Screen

This figure shows the Emergency History and Emergency Response screens of the application. The Emergency History screen displays past SOS alerts with details such as date, time, and status. The Emergency Response screen shows active emergency details and allows responders to accept and track requests in real time. These screens help in monitoring and managing emergency activities effectively. These features help in better monitoring, quick decision-making, and efficient management of emergency situations.

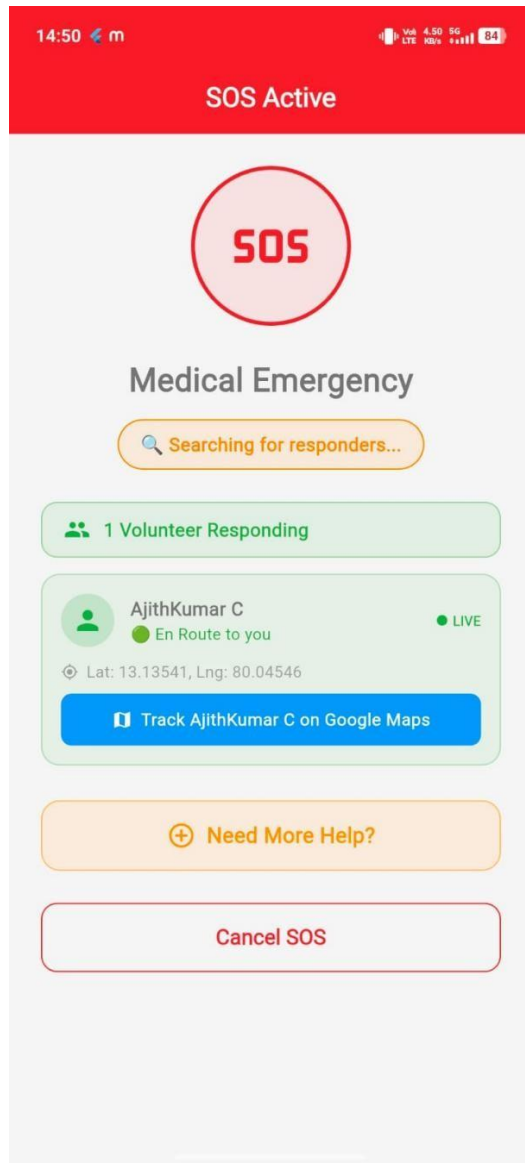


Fig :8 Volunteer Accepted Screen

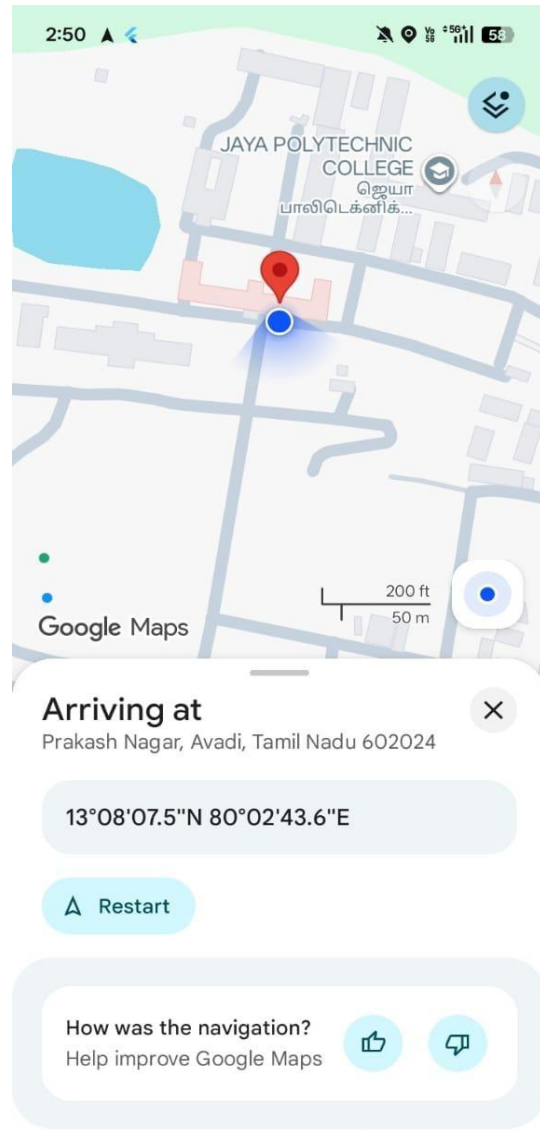


Fig :9 Responders Searching Screen

This figure illustrates the Volunteer Accepted screen and the Responders Searching screen of the emergency application. The Responders Searching screen is displayed immediately after an SOS alert is triggered, where the system actively searches for nearby volunteers, hospitals, or responders within a predefined radius. During this process, the user is informed that the request is being processed, ensuring transparency and reducing anxiety in critical situations.

This screen confirms that help is on the way and displays important details such as responder information, estimated arrival time, and real-time location tracking. The user can monitor the responder's movement and stay informed until help arrives. These screens together ensure a smooth transition from alert generation to response confirmation, improving user confidence and overall emergency handling efficiency.



VII. CONCLUSION

The proposed SOS Emergency Rescue System successfully provides a reliable and efficient solution for real-time emergency assistance using mobile and cloud technologies. The system enables users to quickly send SOS alerts with accurate location details, ensuring faster communication with nearby responders such as volunteers, ambulances, and hospitals.

By integrating Firebase services, GPS tracking, and push notifications, the system achieves real-time data processing and seamless coordination between users and responders. The implementation results demonstrate that the system reduces response time and improves the effectiveness of emergency handling. Overall, the proposed solution enhances public safety by providing a scalable, user-friendly, and technology-driven approach to emergency management.

VIII. FUTURE WORK

1. **AI-Based Automatic Emergency Detection** :Future work can include integrating AI algorithms to automatically detect accidents or abnormal conditions using sensor data. This removes dependency on manual SOS activation. It improves response time in critical situations where users cannot react.
2. **Wearable Device Integration** :The system can be extended to support wearable devices like smartwatches for faster emergency triggering. Users can send alerts directly from wearable sensors. This enhances accessibility and convenience during emergencies.
3. **Direct Hospital and Ambulance Integration** : Future enhancement includes direct integration with hospital and ambulance systems through APIs. This enables automatic dispatch of emergency services without manual intervention. It improves coordination and reduces response delay.
4. **Offline Emergency Alert System** : An offline mode can be implemented using SMS-based alerts when internet connectivity is unavailable. This ensures that emergency messages are still delivered in low-network areas. It increases system reliability in rural and remote locations.
5. **Advanced Real-Time Video Monitoring** :Integration of enhanced video streaming features can allow responders to assess emergency situations visually. This helps in better preparation before reaching the location. It improves decision-making and treatment efficiency.
6. **Machine Learning for Risk Prediction** :Machine learning models can be used to analyze user behavior and predict potential emergency risks. This enables proactive safety measures and early warnings. It adds an intelligent layer to the system.
7. **Large-Scale Deployment and Government Integration** :The system can be scaled to a city or nationwide level by integrating with government emergency services. This ensures wider coverage and standardized response systems. It transforms the application into a complete public safety solution.

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